The Resource
for Environmental Education in Missouri
December 2001 • Vol. 4 • No. 2

What's in it for you?

An entire issue devoted to Energy!

The Energy Zap!

by: Kerry Cordray,
Director Public Information Program,
Missouri Department of Natural Resources' Energy Center

"It is the part of a wise man to keep himself today for tomorrow, and not to venture all his eggs in one basket."
- Cervantes, *Don Quixote. Part i. Book. iii. Chap. ix.*

Teaching about energy can properly draw on the time-honored wisdom in the adage, "Don't put all your eggs in one basket."

In our use of energy, we haven't paid much attention to this advice. For the last hundred years our collective energy "eggs" have been in the "basket" of non-renewable fossil fuels. These fuels comprise over 99 percent of Missouri's sources of energy, as follows:

- Petroleum (42%)
- Coal (37%)
- Natural gas (15%)
- Nuclear energy (5%)

(Energy Information Administration, 1999 data)

Missourians currently spend $12 - $13 billion each year on energy, importing more than 95% of the conventional fuels we consume from outside the state. The warning about our "eggs in one basket" comes visibly home on the price sign at the gas station, when prices soar because of our vulnerability to disruptions in supply. And though it may be many years away, it is a fact that our supply of fossil fuel resources one day will be exhausted.

To prepare for that day, we must begin to develop sources of renewable energy such as solar, wind and biomass. These resources currently provide about .0001% of our state's energy, despite their abundance and availability. Examples of renewable energy resources available in Missouri include electricity generated from wind, solar thermal and photovoltaic cells, biomass such as crop and wood waste, methane gas recovered from landfills and animal farms, and transportation fuels made from biomass, such as ethanol and bio/soy-diesel.

When we develop our own alternative energy sources, our energy costs will be reduced, our environment will be cleaner, and the resulting savings will stay within the state to bolster our own local and state economy.

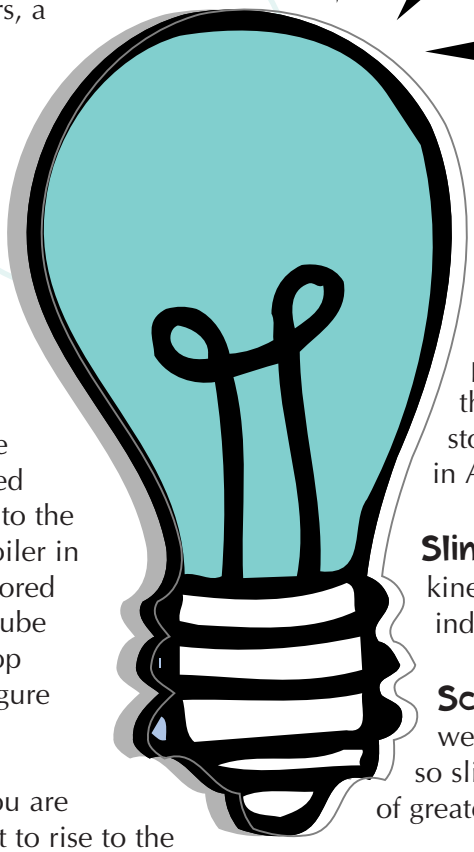
continued on page 4...

Energizing the Teaching of Energy

by Glenda Abney, Program Manager, Gateway Center for Resource Efficiency

Teaching students to understand how energy exists naturally in our world can be challenging. DESE reports students have difficulty on the state assessment tests in two areas: 1) distinguishing differences between potential and kinetic energy and 2) energy transformations. By using simple tools and gadgets, teachers can help students understand these concepts that may otherwise seem abstract.

Here's a few ideas to get you started. With the first tool, hand boilers, a detailed lesson regarding the forms of energy and transformations is provided. In subsequent tools we'll just describe possible transformations.



Hand Boilers - This tool, about 6" tall, is made of clear blown glass. A bulb area at each end is connected by a straw-type tube that allows the colored ethyl alcohol contained inside to move from one area to the other. By cupping the hand boiler in the palm of your hand the colored liquid will travel through the tube from the bottom bulb to the top bulb. The students' job is to figure out why.

The typical response is that you are "heating" the liquid, causing it to rise to the top and boil. Actually the warmth of your hand is heating the air, which warms quicker than the liquid. The hot air displaces the liquid by moving up the tube and coming out at the top, making the liquid appear to be boiling. The heat from the student's body starts this reaction. The heat is a thermal form of energy that came from food they ate. Food is a form of chemical energy. Its energy comes from the radiant and thermal energy coming to earth, allowing photosynthesis to occur. Heat and light get their energy from the sun, nuclear energy. We just traced what happened in the hand boiler back five transformations!

When the students responded to your request to hold the hand boiler mechanical and electrical forms of energy were involved. The sound as they heard the request and the energy involved in the movement of their arm are both mechanical energy. The synapses in their brain, understanding your request and initiating the response to move, was electrical energy. So, you see, energy is all around us, continually being transformed from one form to another! This tool is available at Unique Crafters Company, St. Louis, 1-800-727-4926 and science or teacher stores.

Pop Balls - These common toys are actually just half of a large super ball. Turn the pop ball inside out and drop it on a flat surface. This will cause the pop ball to jump 3-6' in the air, returning it to its original shape. Discuss how we affect the potential energy of different items. Trace back the transformations. Check you local science store for pop balls or contact Peter Fish & Co. in Australia, FAX 612-457-9023.

Slinky's - Great tool for teaching potential and kinetic energy. You can actually see where the individual loops move from potential to kinetic.

Scarves - Throw them in the air as if you were juggling the scarves, they will pause ever so slightly at the top of their curve - the moment of greatest potential energy.

Beach Balls - Fun for teaching mechanical energy. Remember to trace back the sounds of two people communicating when tossing the ball to each other (mechanical), to what gave them the strength (food - chemical), etc.

Happy/Unhappy Balls - Two typical looking super balls. When bounced, one bounces and the other does not. Although you cannot see any

rubber, and the other from conventional neoprene rubber. They have different physical properties, leading to discussion of the potential energy of different types of materials. Several experiments can be done with these tools, including looking at momentum, temperature and compression and their effects. Have students determine which type of rubber is best for car bumpers verses tennis shoes. This tool available from several sources including Edmund Scientific Co. 1-609-573-6250.

Noise Makers - Use any noise maker and focus on sound as energy.

Here are some gadgets to show *electrical energy* in a safe way:

balls. These small plastic balls containing circuits fit in your palm. By touching both metal strips at the same time you close the circuit and the ball reacts by playing music or lighting up. Try this by having a group of people hold hands, with the two ends completing the circuit. This tool available from several sources including Safari Ltd. Miami, Florida.

Easter Chicks - Essentially a circuit ball in the shape of a chick. These common toys show up every Easter at your local stores.

Teaching about energy does not need to be difficult and abstract. There are easy ways to use fun tools to promote a better understanding of the essential role energy plays in our lives.

Forms of Energy

by Glenda Abney, Program Manager, Gateway Center for Resource Efficiency

Energy can be defined as the capacity for matter to work, or the ability to cause change. Energy exists in different forms, with each form behaving in a specialized way. Energy is always moving from one form to another, in transformations.

The basic forms of energy and simple definitions are:

Nuclear - Energy in the bonds holding the nucleus of an atom together. This energy is released by fusion, such as in the sun, where a nucleus of one atom combines with another, or by fission, where a nucleus is split apart, such as in nuclear power plants.

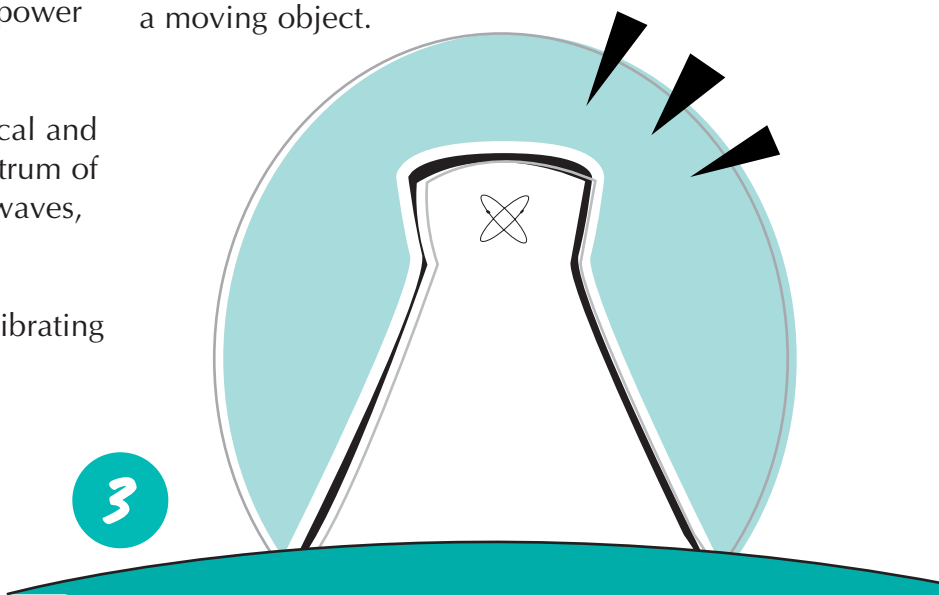
Radiant - Energy waves that vibrate electrical and magnetic fields. The electro-magnetic spectrum of different wavelengths - visible light, radio waves, microwaves, gamma rays, x-rays, etc.

Thermal - Energy of heat. The moving or vibrating molecules in a substance.

Chemical - Energy stored in bonds holding atoms and molecules together. The energy is released when those bonds are broken, most commonly recognized in food, wood, fossil fuels, and chemical reactions.

Electrical - Energy of moving electrons through a conductor. This is naturally observable in lightning and static. Don't mistake this for the electricity we use daily. It is a secondary source we generate by using another source of energy such as the burning of coal.

Mechanical - Energy of motion of an object comprised of **Potential** - the energy an object has because of its position, and **Kinetic** - the energy of a moving object.



The Energy Chain.....

By Kerry Cordray, Director Public Information Program, Missouri Department of Natural Resources' Energy Center

Every time we flip a switch, run hot water, or use a product that was produced with electricity, we are responsible for a chain of events that have far reaching environmental, economic and cultural effects on our world, our state, our neighborhoods and families.

Most of what happens when we flip a switch in Missouri began deep in the ground of the American west. About 83% of our state's electricity is produced by burning coal, imported primarily from Wyoming. Another 11% is generated at the state's only nuclear generating plant, located near Fulton. The remaining 6 percent comes from hydroelectric power, natural gas, wood, fuel oil and other minor sources. The massive scale of the technology and resources involved in shipping fuel, generating electricity and distributing power accord the electric utility industry an important place in our economy.

It's difficult for most people to recall or to imagine what life would be like without the electric conveniences we now take for granted. However, we can't avoid the reality that a byproduct of our appetite for convenience is harm to our environment. Burning fossil fuels to generate electricity pollutes the air with nitrogen oxides, sulfur dioxide, mercury and other harmful pollutants. Emissions from electric plants make up over 80 percent of the total emissions of nitrogen oxides in Missouri. This air pollution from electric generation contributes to the problem of urban smog and to the increased occurrence of asthma and other lung diseases.

In a very real way, the "energy chain" that starts in a Wyoming coal mine, rides the rails to a Missouri power plant, and moves onward through the wires to the computer that this article was written on, is also linked ultimately to disease and even death. To weaken this link in the chain, we need to use newer and better pollution control technologies, increase our use of clean, renewable fuels such as wind and solar energy, and decrease our demand for electricity through greater energy efficiency and conservation.

The Energy Zap!

continued from front cover...

Energy Efficiency = An Energy Resource

For more energy-related wisdom, we can look to two other proverbs: "Waste not, want not." and "A penny saved is a penny earned." The best "alternative" energy source we have – that we don't normally think of as an energy *source* – is efficiency. By eliminating wasted energy, we reduce the need for more energy in the first place.

In a recent report by the Alliance to Save Energy, Missouri ranked fifth in the nation for potential energy savings, primarily due to the potential for substantial improvement in energy standards for building codes.* There are many opportunities for energy efficiency improvements in Missouri homes and businesses. "Getting efficient" will be good for the environment, the economy, and all Missourians.

(*1998, Opportunity Lost: Better Building Codes for Affordable Housing and a Cleaner Environment)

On the Move

by Paulette Strader,
Missouri Department of Conservation

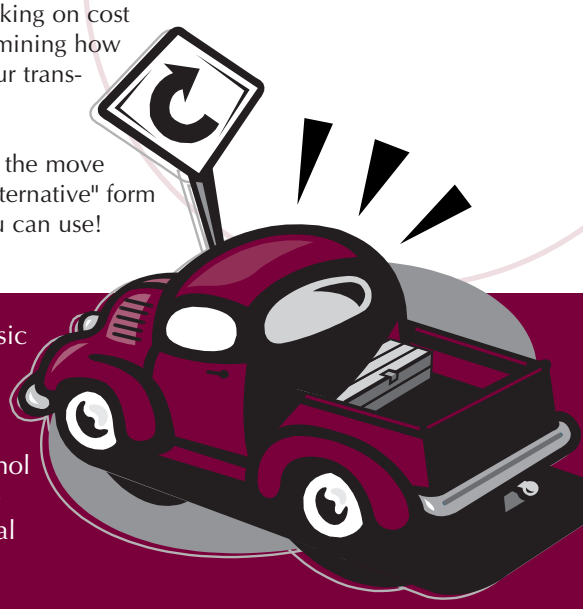
We are a mobile society and results are in the air - pollutants. Travel demand is steadily rising due to increasing population, economic activity and income. What are we doing about the pollutants? For the most part societal concerns have been addressed through emission regulations. To an extent controls have been successful, but development of alternative fuels and types of transportation promise to be even more beneficial.

Solar-powered cars are moving fast in the state of Missouri. Working to perfect their performance are students at the University of Missouri in both Rolla and Columbia. Students from each campus designed and entered separate cars in the July 2001 American Solar Challenge race from Chicago to Los Angeles. The Rolla team placed 2nd while the Columbia team came in 11th. Impressive!
Visit their web sites for detailed information:
University of MO at Rolla - <www.umr.edu/~solar1/intro.htm>
University of MO at Columbia - <http://solar.ee.missouri.edu/>

Visit this site for activities and curriculum on solar cars:
<www.nrel.gov/education/links.html>
A friend to the environment is hybrid transportation which combines two or more sources of power for propulsion. Gasoline-electric hybrid cars are on the market and their benefits include reduction in tailpipe emissions as well as improved mileage. For good basic information visit the website
<www.howstuffworks.com/hybrid-car>

Try magnets as another source for alternative transportation. The magnetic levitation train (maglev) is a high-speed ground transportation vehicle levitated above a track and propelled by magnetic fields. It's energy efficient, uses half the energy per passenger as a typical commercial aircraft, reduces the petroleum use, and pollutes the air less than aircraft, diesel locomotives and automobiles. While the maglev train is operational in other countries, the U.S. is working on cost reduction and determining how to integrate it into our transportation system.

Next time you're on the move think about what "alternative" form of transportation you can use!



Biofuels

Biofuels are alcohols, ethers, esters, and other chemicals made from cellulosic biomass such as herbaceous and woody plants, agricultural and forestry residues, and a large portion of municipal solid and industrial waste. The two most common types of biofuels that are being developed and used in the U.S. are bioethanol and biodiesel. More than 1.5 billion gallons of ethanol are added to gasoline in the U.S. each year to improve vehicle performance and reduce air pollution. Unlike petroleum, which is a nonrenewable natural resource, biofuels are renewable and inexhaustible source of fuel.

Renewable Energy Sources*

Hydroelectric
The U.S. is the world's leading producer of hydroelectric power. Hydro-power currently provides 92,000 megawatts of electricity generating capacity in the U.S. — enough to meet the needs of 28 million households. The nation's largest hydro-power plant is the 7,600-megawatt Grand Coulee power station located on the Columbia River in Washington State.

Biomass
U.S. utilities use biomass to generate more than 7,500 megawatts of electricity, providing enough power to meet the energy needs of several million households. It is more expensive than other sources of electricity, principally because it is costly to transport fuel from its source to the incinerator.

Geothermal
U.S. geothermal plants currently have a total electricity generation capacity of 2,700 megawatts. Producing enough electricity to meet the residential electricity needs of more than 3.5 million people. The world's largest geothermal power plant, the Geysers Power Plant, is located in northern California.

Solar
The U.S. annually uses more than 71 trillion British Thermal Units (BTUs) of solar energy. One million BTUs equals 90 pounds of coal or eight gallons of gasoline.

Wind
The U.S. currently has more than 1,600 megawatts of installed wind-power generation capacity, producing about three billion kilowatt-hours of electricity each year. That's enough electricity to meet the annual residential electricity needs of more than one million people. More than 90% of the total wind power produced in the U.S. is generated by three California wind farms. The majority of this usable resource blows across the Great Plains. North Dakota alone has enough suitable wind resource to supply 36% of the electricity consumed in the U.S.
*From - *Mother Earth News, February 1999*

Your School Building as an *Energy Learning Lab*

By Glenda Abney, Program Manager, Gateway Center for Resource Efficiency

A hands-on, interactive way to teach students about energy is to use their school building as a learning lab. Teaching students to research energy use and determine ways to be more efficient in their building provides multiple results. Increasing efficiency conserves natural resources, saves money for the school, increases comfort and provides valuable learning experiences.

Researching energy use in a building includes several steps: 1)**Monitor your school's utility bills.** Develop a baseline from the past three years - a simple average of monthly use - and compare it to current use. While the baseline does not take into consideration differences in yearly weather conditions or additional equipment loads, it can give a general guideline of energy use in the building. If students actually initiate a project to save energy, comparing utility bills is a good way to determine the impact. Teachers can integrate science and math lessons by challenging students to develop graphs and charts on the topic.

2) **Interview the building maintenance staff and get a behind the scene tour of the boiler room.** Ask about the type of heating and cooling system used, how temperatures are controlled, what limitations exist, what opportunities exist for improving efficiency, etc. A tour of the boiler room will give students a better understanding of the operation and greater respect for the maintenance staff.

3) **Conduct a comfort survey.** Survey each staff member that maintains a room with respect to the comfort level of their room during each season, their use of lights and windows, etc. Using a map of the building color code the areas with the greatest comfort problems. Students can then chart and graph results.

4) **Do an energy audit.** Develop a simple tool (or research to find existing ones) to evaluate the school's energy efficiency. The energy audit can be very simple or quite detailed. Use customized questions for each type of room:
- **classrooms** check for airtight windows, use of window shades, equipment turned off when not in use, type of light bulbs, use of light reflectors, efficient light ballasts, etc.
- **bathrooms** check the same items listed above plus see if faucets are shut off completely, if water-flow restrictions and aerators are being used, if toilets are shut off between flushes, if water is left running, etc.
- **offices** add to the classroom check list by asking questions related to the efficient use of printers and copiers.
- **hallways and entrances** check to assure outside doors are airtight and closed during heating and cooling periods, determine what type of light bulbs are used in exit, hallway and outdoor lights, and check the efficiency of drinking fountains.

Additional research should include the age of the building, hours of use, description of preventative maintenance program, use of efficient landscaping, type of insulation, temperature of water heater as well as documentation of recycling programs. These factors combine to present the "total picture" of energy use at school.

Audit results are the tool for constructing a list of energy efficient improvements. From that list students can develop projects and take action.

School Energy Efficiency Development.....

School **E**nergy **E**fficiency **D**evelopment (SEED) reduces utility costs through building improvements, energy education and behavior changes. It involves educators, administrators, custodians, parents, businesses and students in turning wasted watts into district dollars. For further information contact the Gateway Center for Resource Efficiency, 3617 Grandel Square, St. Louis, MO 63108 phone 314-577-0220 or visit their website at <**gateway.enter@mobot.org**>

Project Resource Guide: Energy

Fire up your energy and check out these great classroom ideas. These activities from Project WILD, Learning Tree, and WET are interdisciplinary, hands-on, easy to use, correlated to state standards, and guaranteed to energize your students. If you don't have these materials and would like to receive them, contact the coordinators listed.

PROJECT WILD

Energy Pipeline - 2001 Edition Page 105- Simulate organic production and energy loss for major trophic levels in an ecosystem. *(Grades 7-8)*

Flip the Switch for Wildlife - Page 323, 2001 Edition Page 308 - Identify the route of energy from its sources to human use and explore ways to lessen negative effects on wildlife. *(Grades 5-8)*

Hooks and Ladders - Aquatic Page 43, 2001 Edition Page 76 - Discover the effects of hydro- electric dams on salmon migration. *(Grades 5-8)*

To Dam or Not to Dam - Aquatic Page 134, 2001 Edition Page 170 - Role play the differing perspectives and concerns related to the complex issue of constructing a dam on a river. *(Grades 4- 12)*

Dam Design - Aquatic 2001 Edition Page 179 - Explore the positive and negative effects of dam design on wildlife, humans, and the environment. *(Grades 9-12)*

For more information on Project WILD and Learning Tree workshops and materials contact: Bruce Palmer, State Coordinator, Missouri Dept. of Conservation, PO Box 180, Jefferson City, MO 65102-0180, (573) 751-4115 extension 3113, <palmeb@mail.conservation.state.mo.us>.

PROJECT Learning Tree

Energy Sleuths - Page 126 - Identify different sources of energy and how it is used in our daily lives. *(Grades 6-8)*

A Look at Aluminum - Page 180 - Discover how aluminum products are made and gain a better idea of the environmental impact of using this nonrenewable but recyclable resource. *(Grades 5-8)*

On the Move - Page 185 - Examine transportation systems that are vital to your community. *(Grades 4-8)*

Waste Watchers - Page 274 - Look at how energy is used at home and discover ways to reduce energy waste. *(Grades 5-8)*

Resource-Go-Round - Page 316 - Discover how natural resources are turned into products and, when possible, recycled into new products. *(Grades 4-8)*

Air to Drive - Page 325 - Calculate how the family car contributes to automobile emissions and energy use, and determine ways and benefits of reducing those levels. *(Grades 5-8)*

PROJECT WET

Energetic Water - Page 242 - Identify the forms of energy in water and see how water can be used to do work. *(Grades 4-8)*

Money Down the Drain - Page 328 - Through observation and simple calculations, discover that a dripping faucet wastes a valuable resource. *(Grades 4-8)*

The Price is Right - Page 333 - Recognize that economics and environmental planning are part of the cost of building a water development project. *(High School)*

For more information on Project WET workshops and materials contact; Joe Pitts, State Coordinator, Missouri Dept of Natural Resources, PO Box 176, Jefferson City, MO 65202, (800) 361-4827, **<nrpittj@mail.dnr.state.mo.us>**

The Library

Conservation and Environmental Education Resources

Web Resources

World of Energy Information

<www.energyideas.org>
What's New, Tip of the Day, Glossary, Web Links, Publications and more.

Energy Lessons for Students

<www.fe.doe.gov/education/main.html>
An introduction to the fuels we use most to power our economy-and if we can develop the right technology, fuels that can power us into the future.

Energy Information Administration

<www.eia.doe.gov>
Energy from A to Z with a specialized kid's page.

Center for Renewable Energy and Sustainable Technology (CREST)

<www.crest.org>
Information source on a variety of energy topics including education for students.

The Energy that Surrounds You

<www.energy.gov.>
Special school and kidz zone with activities, contests, art projects and programs for all grade levels.

Missouri's Energy Center

<www.dnr.state.mo.us/de/homede.htm>
This center helps Missourians use and produce energy wisely and efficiently and offers a site for kids and educators.

Going Places, Making Choices

<www.fourhcouncil.edu/ycc/DYCC.HTM>
Free innovative curriculum from the National 4-H Council on raising the awareness of high school age youth about transportation, personal mobility choices now and in the future and how those choices impact the environment. At this site click scahill@fourhcouncil.edu

Publications

Energy Education Resources

Kindergarten through 12th Grade. A listing of free or low-cost energy-related educational materials. Free from the National Energy Information Center (202)586- 9254 or www.eia.doe.gov

Energy, Atmosphere & Climate:

Teacher's Guide. Superb resource for secondary teachers on energy sources, atmosphere and climate. #BW-7255 ($8.95) through Acorn Naturalist PO Box 2423, Tustin, CA 92781-2423, (800)422-8886, http://acornnaturalists.com

Videos

Contact Noodlehead Network at 1-800-639-5680 for free previewing and video costs of the following:

Simple Things You Can Do To Save Energy In Your School

Intro to energy auditing presents the topic in a fun way. Grades 4-8.

Simple things you Can Do To Save Energy: The Power is in Your Hands

Video on home auditing. Grades 3-8.

Petro Producers

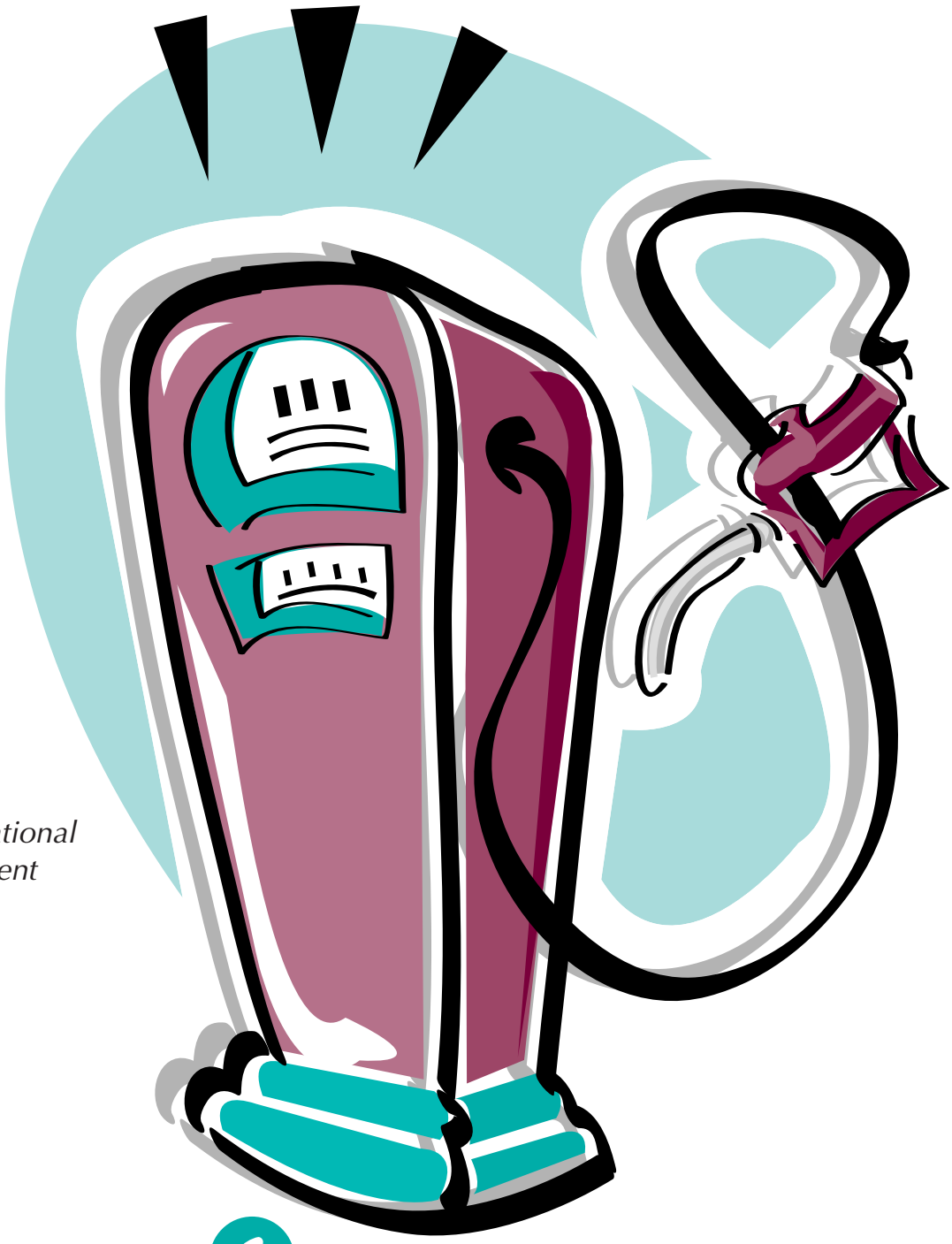
With the United States increasing dependence on petroleum we currently look to other countries to supply two-thirds of our needs. Almost half of our imported oil comes from OPEC countries (Organization of Petroleum Exporting Countries).

Top Oil Producing Countries 1998
1. Saudi Arabia
2. United States
3. Russia
4. Iran
5. Venezuela

Top Sources of U.S. Imported Oil 1998
1. Venezuela - OPEC
2. Canada - non-OPEC
3. Saudi Arabia - OPEC
4. Mexico - non-OPEC
5. Nigeria - OPEC

Top Petroleum Producing States
1. Texas
2. Alaska
3. California
4. Louisiana
5. Oklahoma

From: The NEED Project (National Energy Education Development Project)



EE Calendar

Check It Out

<www.conservation.state.mo.us/teacher/workshops> has up-to-date information on the Missouri Department of Conservation's teacher workshops. There's something for everyone!

December 8

Decorating for Wildlife
Missouri Department of Conservation office
2500 S. Halliburton, Kirksville
9:00 am -11 am
When winter is harsh, it's hard for wildlife to find food and it becomes difficult for them to meet their needs to survive. Participants in the workshop will learn to decorate with natural and native items while providing food sources for the wildlife found in their area. Supplies will be provided. Contact Karen Armstrong, (660) 785-2420

January 12 and 26

Biodiversity Basics
St. Louis Zoo Teacher Workshop
Grades 5-12
8:30 am - 4:30 pm
Examine different levels of biodiversity (genetic, species and ecosystems), why it's important, the status of biodiversity and what people are doing to protect biodiversity. Covers many state and national science standards and MAP items. $40 (1 hour graduate credit option, Lindenwood University)
Call 314-768-5466

January 26-27

The Land in Literature: Reading the Landscape
Montauk State Park, Salem
Connections to the land with activities covering classical environmental literature, natural history interpretation, stream dynamics and land form interpretation. Sessions include training in the use of Leopold Education Project in the classroom. $40 (1 hour credit, Lincoln University).
Contact Joe Pitts, Jim Lubbers, or Bryan Hopkins at the Missouri Department of Natural Resources, 1-800-361-4287 or (573) 526-6627

February 9-10

Used Oil Recycling Education Program
MO Dept. of Natural Resources, Jefferson City
This course will train teachers to apply the issue investigation approach to learn about barriers to and the benefits of recycling used motor oil. $30 (1 hour credit, Lincoln University).
Contact Joe Pitts, Jim Lubbers, or Bryan Hopkins at the Missouri Department of Natural Resources, 1-800-361-4287 or (573) 526-6627

February 16 and March 2

The Diversity of Vertebrate Life
St. Louis Zoo Teacher Workshop
Grades 1-4
8:30 am - 4:30 pm
Focuses on specific animal groups - reptiles and amphibians, bird, carnivores, and hoofstock and elephants. Teachers will learn about the natural history, adaptations and ecology of the animals, receive activities to conduct in the classroom and meet animal division staff and animals during a tour. Materials are tied to MO Show-Me Standards and Curriculum. $40 (1 hour graduate credit option, Lindenwood University)
Call 314-768-5466

February 23,

Project WILD for Teachers
Location to be announced
9:00 am - 4:00 pm
Fee: $20.00
This 6 hour workshop is designed for teachers to learn ways to help their students become stewards of the land and

improve their understanding of conservation. Wildlife and their habitats including aquatic ecosystems will be included. Teachers will receive curriculum guides with more than 150 interdisciplinary, hands-on activities correlated to the Show-Me Standards.
Contact Karen Armstrong, (660) 785-2420

February 26

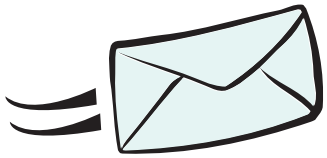
Project WILD for non-formal educators
9:00 am - 4:00 pm
University Outreach and Extension
503 E. Northtown Road, Kirksville
Fee: $20.00
This workshop is for youth leaders and non-formal educators who wish to teach adults or children how to be stewards of the land. It is designed to help with the understanding of conservation and the wise use of our natural resources. Participants will receive curriculum guides with more than 150 interdisciplinary, hands-on activities for all age groups. Topics presented are on wildlife and their habitat including aquatic ecosystems.
Contact Karen Armstrong, (660) 785-2420

March 23-26

National Association for Interpretation
Region VI Annual Workshop and meeting
Baton Rouge, LA
Contact Ray Berthelot (225)342-8111 or rberthelot@crt.state.la.us

January and February 2002

Wyman Center Summer Employment Opportunity
Youth development agency hiring staff for two summer camps. If you are interested in outdoor education, camp counseling, adventure ed or program staff positions, contact Rachel Crosetto at (636)296-4480 or Dave Knobbe (636)296-4480



Paper Facts

Environment Recycled Paper is made from Over 75% recycled paper including 25% post consumer fibre.

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ENVIRONMENTAL CHOICE · CHOIX ENVIRONNEMENTAL

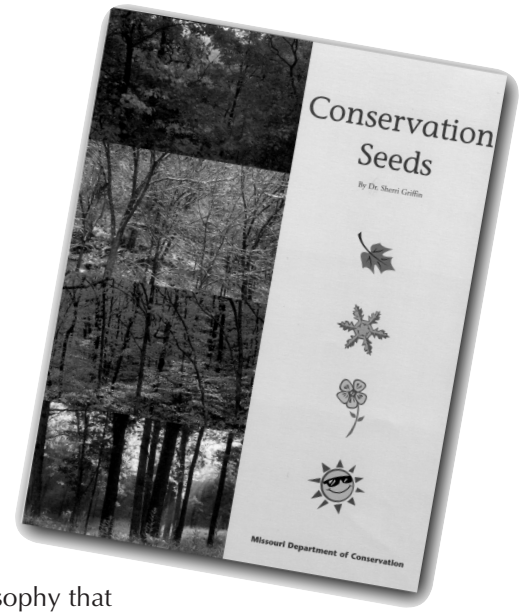
From Garbage to Gas

Landfill gas emitted from decomposing garbage is a reliable and renewable fuel option that remains largely untapped. This gas is about 50% methane (CH4) also known as natural gas, and 45% carbon dioxide (CO2). Instead of allowing landfill gas to escape into the air, the gas can be captured, converted, and used as an energy source. Pattonville High School in Maryland Heights, Missouri has tapped into this energy source to heat their school. A 3,600 foot pipeline carries gas from the local landfill to the schools boilers. This alternative energy source saves the school an estimated $40,000 annually.

Teacher resources

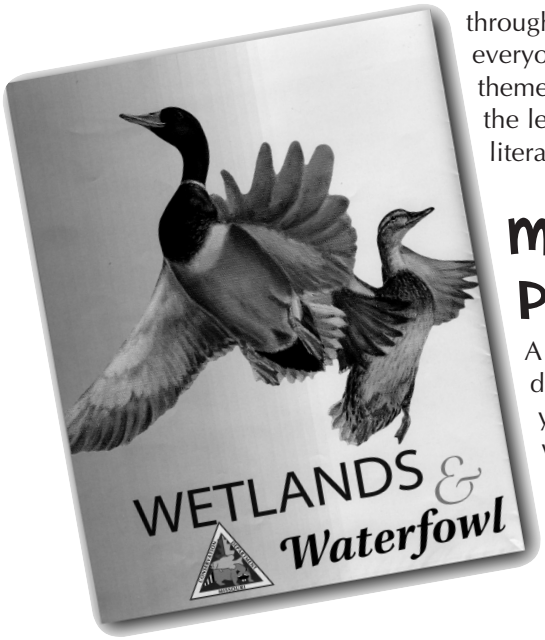
Two new offerings from the Department of Conservation

Conservation Seeds



Developing good habits at an early age–it's the thing to do. The Missouri Department of Conservation wants to do just that with its early childhood curriculum *Conservation Seeds.* Resources are at your fingertips to help the minds of young children become aware of nature and conservation.

In keeping with educational advancements, the Department of Conservation has revised the original 1983 version of *Conservation Seeds* for release in September 2001. This hands-on book of activities for three- through seven-year olds, clearly follows the philosophy that everyone learns best by doing. The curriculum is organized with seasonal themes to make it user-friendly. Each topic is supplemented with activities to expand on the learning event. In addition, a special section designated by topic lists children's literature appropriate for the classroom.



Missouri WETLANDS & Waterfowl Poster

A new dramatic full-color poster from the Department of Conservation vividly displays Missouri's wetlands and waterfowl. Experience a fall hunting expedition as you enjoy this dramatic piece of art. The reverse side offers waterfowl and wetland wildlife identification as well as numerous activity ideas.

To receive a copy of this publication or poster write to:
Distribution Center, Missouri Department of Conservation,
PO Box 180, Jefferson City, MO 65102

Recruiting Grades 4 - 9 Science Teachers

Middle level teachers interested in environmental issues are being recruited for participation in ENVISION. The program, funded by the National Science Foundation and held at Purdue University, will train leadership teams through active research while focusing on environmental issues, standards-based curriculum building and partnership building. Leadership teams must consist of two participants; one requiring more time commitment than the other. Module descriptions for the institute include:

- Water and Watersheds - emphasis is on environmental science concepts and issues surrounding water, streams and wetlands.
- Urban and Built Environments - environmental concepts and issues related to buildings, cities and suburbs are investigated.
- Rural Environments - the effects of human activities and agricultural practices on rural environments are explored.

Dates for the institute are: Spring Pre-institute -April 25 - 27 Summer Institute - July 8 - 30
Application Deadline is February 15
For further information check the web site <http://www.eas.purdue.edu/geomorph/envision> or email at envision@purdue.edu or send your name and address to ENVISION 1441 LAEB Dept. of Curriculum & Instruction, Purdue University West Lafayette, IN 47907-1442 Phone 765-494-0803

Conservation Curriculum

Energizing Minds

Linking energy and conservation is what it is all about. The curriculum insert for this issue of *The Resource* provides three levels of activities:

Early childhood - " Energy puzzles" help children match energy users with the forms of energy used. This is just one of several early childhood lessons in energy taken from the recently revised publication *Conservation Seeds.* Refer to page C-8 for complete information on this publication that helps young children become aware of nature and conservation.

Grades 5-8 - "Name that Energy Source" teaches students about renewable and non-renewable energy sources. What are our options for the future?

Grades 9-12 - "What a Bike!" incorporates math skills in calculating the static efficiency of a bicycle. What a great opportunity to discuss alternative transportation!

From the Department of Natural Resources

MISSOURI
DEPARTMENT OF NATURAL RESOURCES

The Department of Natural Resources offers a graduate credit course titled ENERGY FOR MISSOURI: TODAY AND TOMORROW. This two-day session is designed to provide teachers with a basic understanding of energy use and present methods for teaching these issues in the classroom. Participants receive educational activities promoting energy awareness and energy conservation practices. For more information concerning this course or additional environmental education classes offered by the Department of Natural Resources contact the Environmental Education Unit at 1-800-361-4827.

eNLIST

Grades 5-12 teachers needed

The Missouri Department of Conservation wants to recruit you. We are currently working on new materials for our junior high and high school audiences. There are two types of involvement:

First, you can fill out a short survey to help us determine the best possible products for you. What criteria must a lesson plan or activity fulfill? What types of media work best for you? If you are willing to fill out one of the surveys, please contact us and we will mail it to you.

Second, you may wish to participate in product development. This is done in a couple of ways:

- Occasionally we contract with an individual to write a short activity, review a manuscript, develop correlations, etc.
- Often we contract with a teacher to serve as part of a development team for a specific product. Products that may require development teams this year include WebQuests and Thematic Units. If you are interested in being a candidate for participation in upcoming projects please mail a cover letter and short resume. We ask that you provide specific information about your interests in conservation so that we can best match you to a topic and/or product.

Missouri Department of Conservation
JH/HS Curriculum
PO Box 180
Jefferson City, MO 65102-0180
(573) 751-4115
grayg@mail.conservation.state.mo.us

Energy Puzzles

PreK-2

This early childhood lesson comes from the recently revised edition of *Conservation Seeds*. Please refer to page C-8 for complete information on this publication.

Objectives:

This activity will help young children match energy users with the energy. This manipulative lesson will test their fine-motor skills, eye-hand coordination as well as provide a basis for questioning and explanation.

Materials:

- Clear contact paper
- Copy of energy puzzles (copy page) mounted on cardboard

Procedure:

1. Color and cover the energy puzzles with contact paper and cut them apart.
2. Place the energy puzzles in the manipulative area during self-selected activity time.
3. Encourage children to match the energy-users to the types of energy used. Discuss their choices and how the puzzles fit together.

Questions you might ask:

.What kinds of energy do you use at your house?
.What would happen if we ran out of any of these kinds of energy?

Supplementary activities:

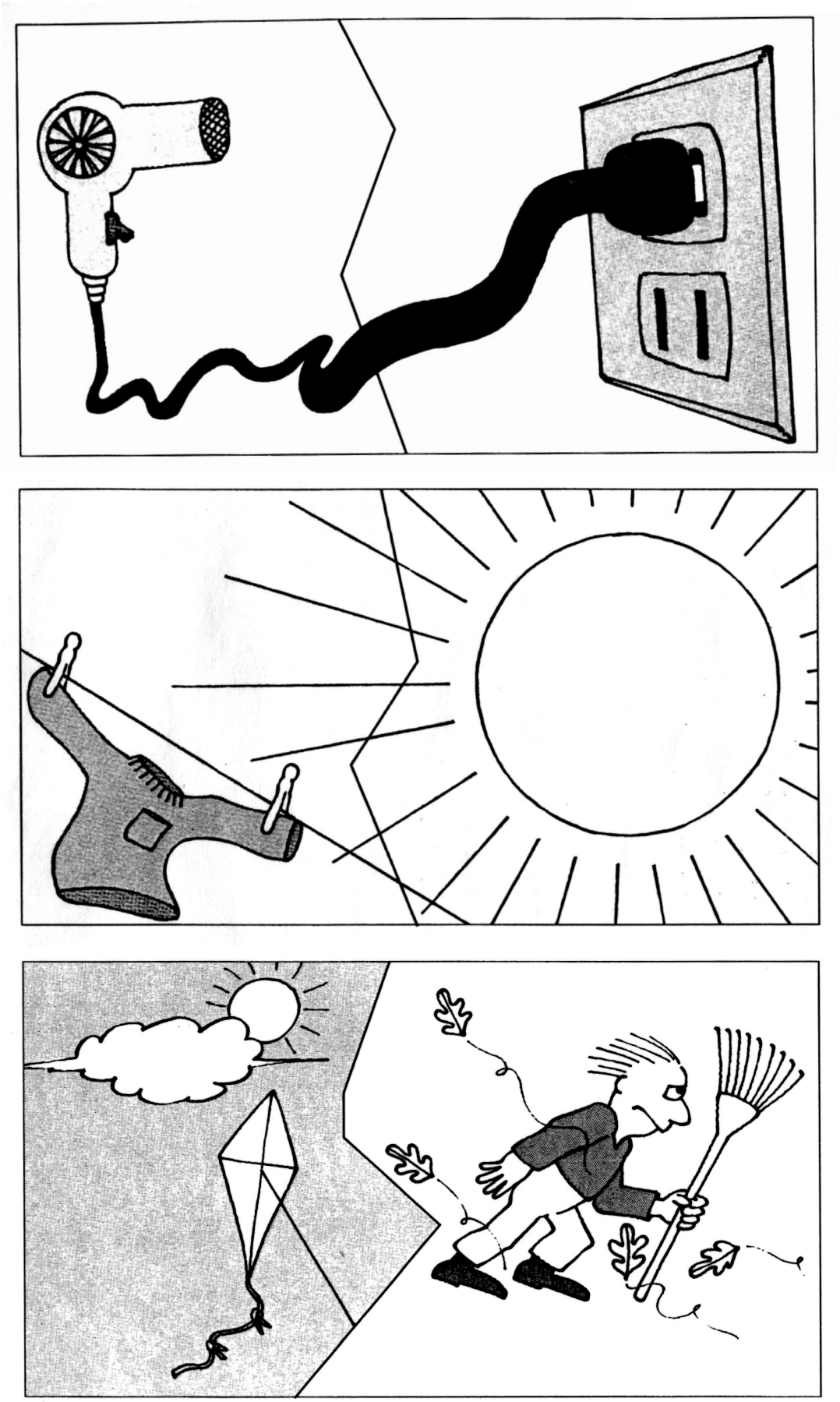
A. Block –Make small gas tanks from toilet paper rolls or milk jugs to use with cars and trucks during self-selected activity time.
B. Group – Read the electric and water meters at the school. Chart the usage each month.
C. Music –Sing "Row, Row, Row Your Boat" and discuss the type of energy needed to row a boat.
D. Outside –Make gas tanks, with hose attached, from large cardboard boxes. Place them outside for use with tricycles.
E. Science – Bring in a selection of wind-up toys and discuss where they get their energy.

Children's Literature

Taken from the special children's literature section in *Conservation Seeds* is this listing of energy related books appropriate for the classroom:

Berger, Melvin. *All About Electricity.* New York: Scholastic, Inc., 1995
———-. *Switch On, Switch Off.* New York: HarperCollins, 1990.
DeRegniers, Beatrice Schenk. *Who Likes the Sun?* New York: Harcourt Brace, 1961.
Gibbons, Gail. *Sun Up, Sun Down.* New York: Harcourt Brace, 1983.
Lionni, Leo. *Alexander and the Wind-Up Mouse.* New York: Knopf, 1987.
Pondendorf, Illa. *The True Book of Energy.* Chicago: Children's Press, 1963.

Teachers please note: *Conservation Seeds includes four additional energy lessons in the winter section– Lesson 21, page 120; Lesson 22, page 122; Lesson 24, page 126 and Lesson 27, page 132.*



Name That Energy Source

5-8

Objectives:

After completing this activity, students should be able to:
1. Define renewable and non-renewable energy sources. [2.3, 4.1, CA1, CA6, SC1]
2. Research and describe a particular energy source. [1.2, 1.4, 1.9, 3.8, 4.6, CA1, CA3, SC1]
3. Create a group presentation. [1.5, 2.1, 1.6, CA1, CA5, SC1]

Materials:

Research materials on renewable and non-renewable energy sources

Background:

1. Have students form groups of 3-4.
2. Ask each group to develop their own generic definition for the following words: **energy, resource, renewable, alternative**.
3. Have one member from each group write their group definitions on the chalkboard under the appropriate headings.
4. Discuss all definitions as generic words and then steer the discussion toward energy, renewable and non-renewable resources, and alternative energy sources.

Energy: the ability or capacity to do work.
Resource: means of support; materials found in the environment that can be extracted for human use.
Renewable: able to restore; renewable energy is energy from sources that cannot be used up: sunshine, water flow, wind and vegetation and geothermal energy, as well as some combustible materials, such as landfill gas, biomass, and municipal solid waste.
Non-renewable: unable to restore, non-renewable energy is from sources that can be used up: fossil fuels (including coal, crude oil, natural gas)
Alternative: An additional option; alternative energy sources are renewable energy sources as opposed to the non-renewable resources commonly used today.
Fossil fuels: fuels formed eons ago from decayed plants and animals. Oil, coal and natural gas are such fuels.
Nuclear energy: the energy trapped inside an atom; nuclear reactors use radioactive uranium to perform fusion of two atoms; this is the same reaction that the sun uses to provide solar energy

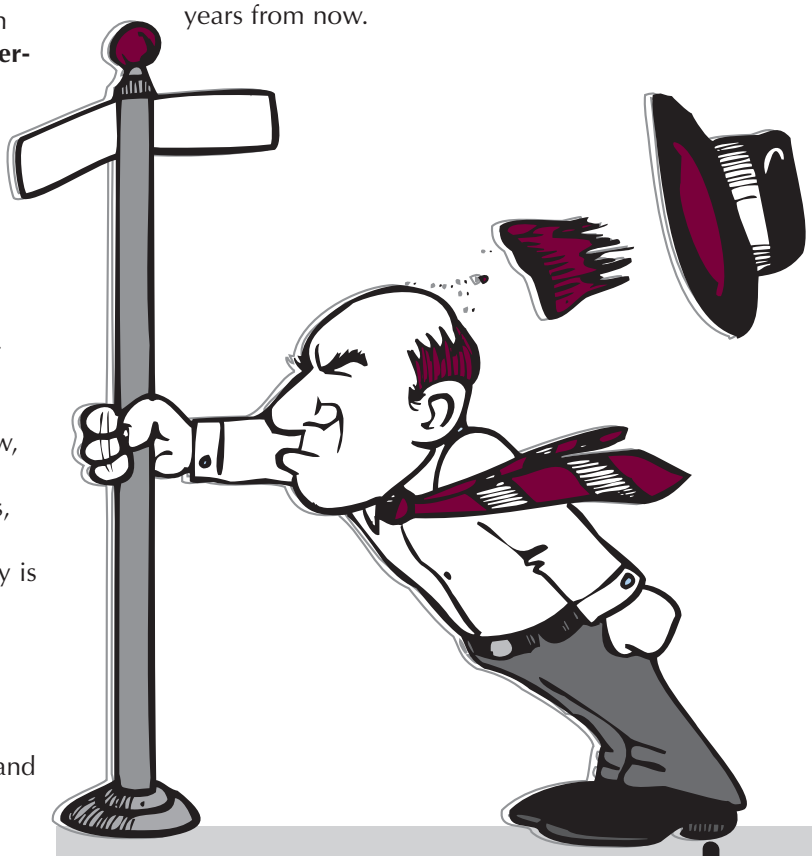
5. In their groups, have students sort the energy sources on the copy page into renewable, non-renewable, or nuclear energy sources. Ask students where they think your community's electricity comes from?

Procedure

1. Have each group research the origin, use, and future of one of the following resources: Fossil fuels, nuclear, hydroelectric, solar, wind. Students should:
   a.Explain the history of the resource. How long has it been used? Is it commonly used today?
   b.Trace the origin of your energy source back to its original source (e.g., A wood stove uses wood as its energy source. Wood comes from trees. Trees use the sun to make food. Therefore, the original energy source for a wood stove is the sun!)
   c.Identify some positive and negative aspects of your energy source.
2. Have groups present their results to the class. Groups should come up with a visual aid for their presentation (poster, skit, commercial, power point,etc.).

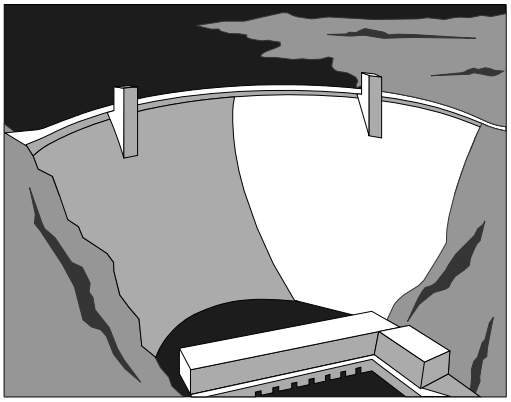
Extension:

Have students write an essay on the following topic: Predict what energy sources will be prevalent one hundred years from now.

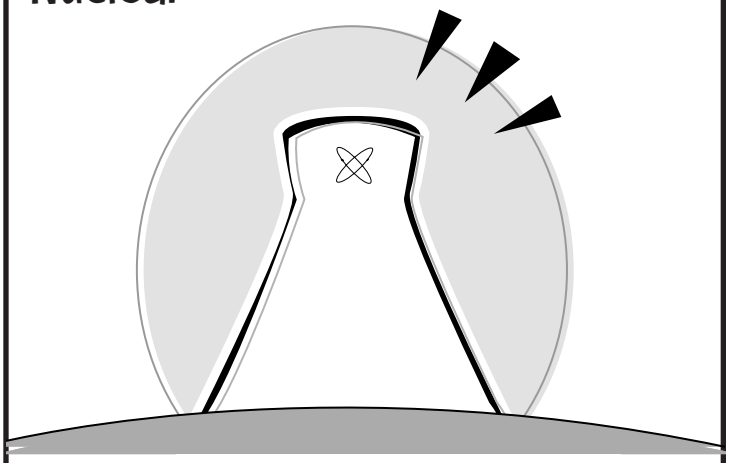


OUTSIDEin is a student level insert to the Department of Conservation's official monthly publication *Missouri Conservationist.* After reading "Writing with Lewis and Clark" taken from **OUTSIDEin** in the November issue of *Missouri Conservationist,* have students research and read additional excerpts from the journals of Lewis and Clark. Students can then compare the energy resource available at that time to the present time and what might be in the future.

Hydroelectric

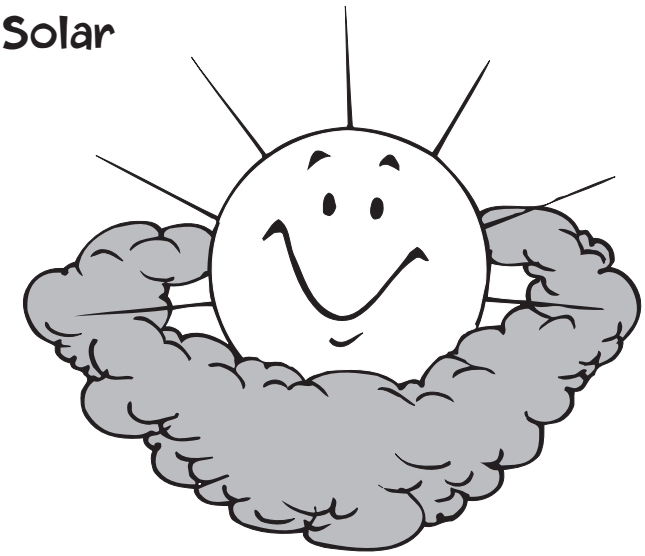


Nuclear

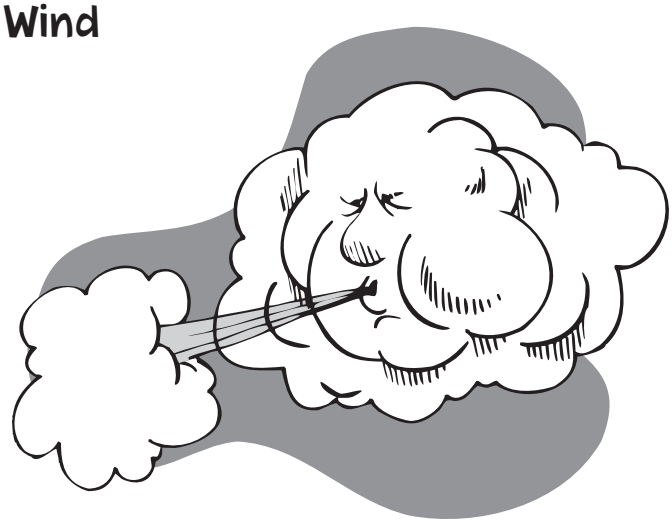


Fossil Fuels
(coal, crude oil, natural gas)

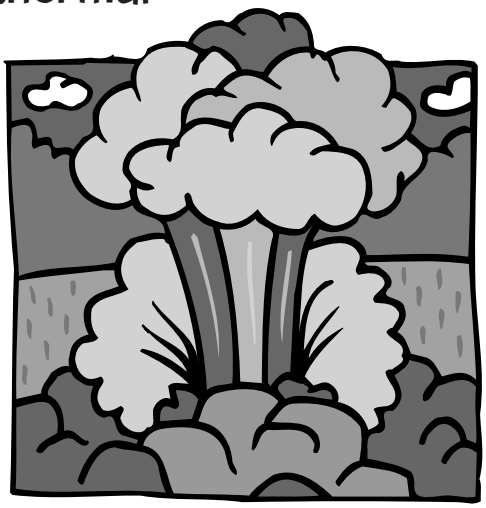
Solar



Wind



Geothermal



What a Bike!

Objectives:

After completing this activity, students will be able to:
1.Evaluate the modes of transportation that students take to school. [1.2, 3.8, CA1, CA6, MA1, SC1, SC8]
2.Calculate the static efficiency of a bicycle. [1.2, 1.6, 1.8, 3.5, CA4, MA1, MA2, SC1, SC2, SC8]

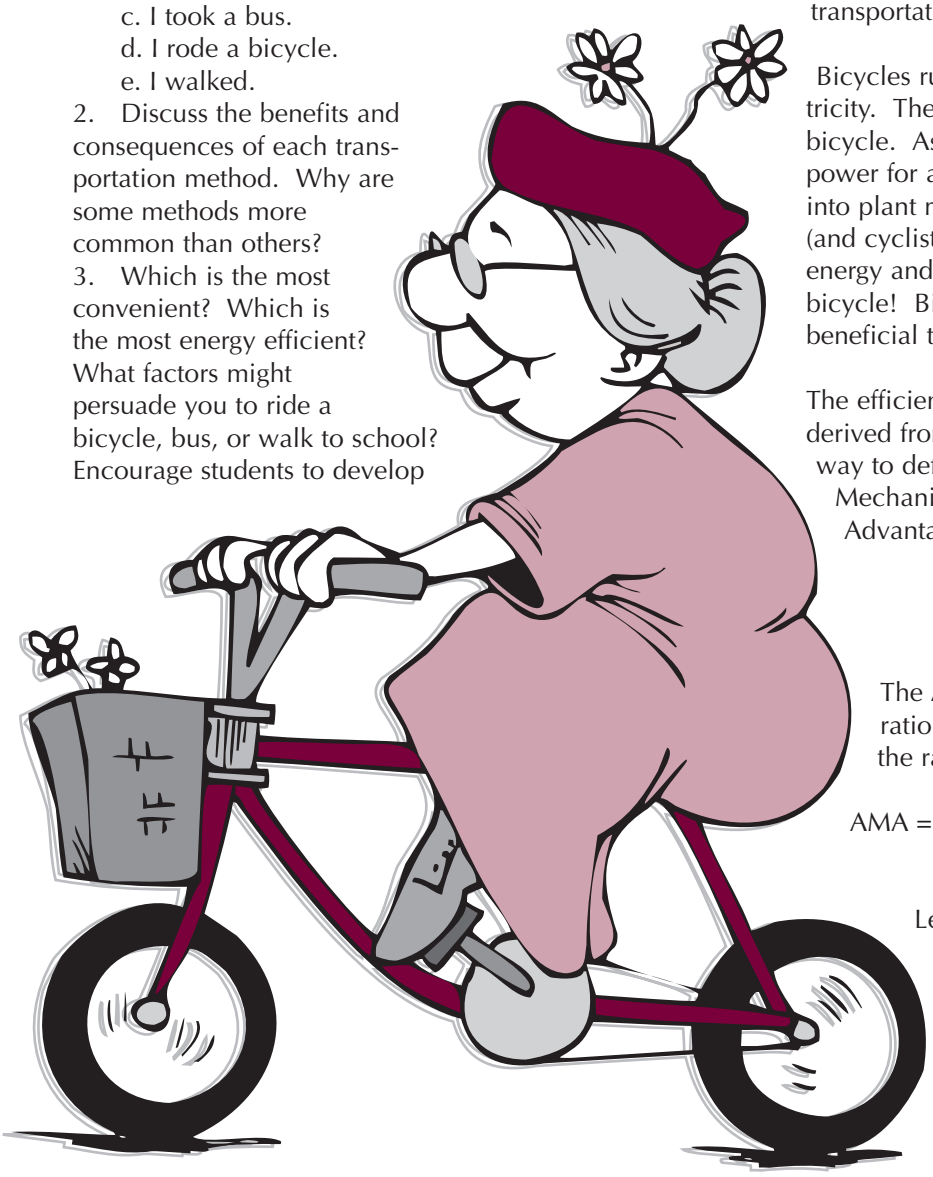
Materials:

Bicycle, bathroom spring scale, masking tape, meter stick

Procedure:

Part A.

1. Have students take a poll to determine how each student got to school this morning.
   a. I drove to school with no passengers.
   b. I drove or rode in a vehicle with one or more passengers.
   c. I took a bus.
   d. I rode a bicycle.
   e. I walked.
2. Discuss the benefits and consequences of each transportation method. Why are some methods more common than others?
3. Which is the most convenient? Which is the most energy efficient? What factors might persuade you to ride a bicycle, bus, or walk to school? Encourage students to develop a school-wide action plan that would promote energy conservative methods of transportation.



9-12

Part B.

Use the student handout to direct students in determining the efficiency of a bicycle.

Background

Bicycles were invented in the early 1800s and have had the same basic form for the past century. Although you may be most familiar with the bicycle as a form of recreation, many people around the world use them as their primary means of transportation.

Bicycles are the most efficient form of transportation. It takes less energy to move a kilogram of body mass over a distance of one kilometer by using a bicycle than any other transportation method!

Bicycles run on human energy, rather than gasoline or electricity. Therefore, no pollution is created when riding a bicycle. As with all sources of energy, the original source of power for a bike is the sun! The sun's energy is transformed into plant material through photosynthesis; other animals (and cyclists) eat these plants; a cyclist metabolizes this food energy and transforms it into mechanical energy through a bicycle! Bike riding is a good form of exercise and can be beneficial to your health.

The efficiency of a machine is the ratio of the useful work derived from the machine to the energy put into it. Another way to define efficiency is as the ratio of the Actual Mechanical Advantage (AMA) to its Ideal Mechanical Advantage (IMA).

$$\text{Efficiency} = \frac{\text{AMA}}{\text{IMA}}$$

The AMA of a bicycle can be found by taking the ratio of the Force Output to Force Input. The IMA is the ratio of the Input Distance to Output Distance.

$$\text{AMA} = \frac{\text{Output Force}}{\text{Input Force}} \qquad \text{IMA} = \frac{\text{Input Distance}}{\text{Output Distance}}$$

Let's use these formulas to calculate the efficiency of a bicycle.

Determining Bicycle Efficiency

Bicycles are the most efficient form of transportation. Using the formulas below, calculate just how efficient they are.

Procedure:

1. The Input Force for a bicycle is the weight of the cyclist. Chose a person as the "cyclist" and measure his/her weight using a bathroom spring scale. If the scale is in pounds, convert the number into kilograms (1 kg = 0.453592 pounds). Record this number on Line A.
2. To find the Output Force, have someone hold the scale against a wall at the height where the bicycle wheel will hit it squarely. Have the chosen "cyclist" back the bicycle slightly away from the wall so that the pedals of the bicycle are in a horizontal position. The cyclist should then press down on the front pedal so that the bicycle bumps into the scale. Do this while standing and try to have your entire weight on the pedal. Record the force applied to the scale in kilograms on Line B.
3. The Input Distance for the bicycle is the circumference of the pedal rotation. Find this by measuring the radius (r) of the pedal rotation (the distance from one pedal to the central axis). Calculate circumference by using the formula: C = 2(pi)r. Record your answer on Line C in meters). (PROVIDE DIAGRAM)
4. The Output Distance is the distance the bicycle moves in one pedal rotation. Move the bicycle to an open space. Mark the front wheel's original position on the floor with masking tape. Using your hand, take the pedal and move it through one complete revolution. Mark the new front wheel position on the floor with masking tape. Measure the distance between these two points in meters and record on Line D.
5. Calculate the Actual Mechanical Advantage on Line E.
6. Calculate the Ideal Mechanical Advantage on Line F.
7. Calculate the bicycle's Efficiency on Line G.
8. Optional: Repeat with the bicycle in different gears. Is there any difference in the efficiency of high and low gears? Why do you think this might be?

Questions:

1. Studies of bicycles in wind tunnels have shown efficiencies of 80% or greater. Why might your efficiency results be lower than this? What human or experimental errors may have affected your results?
2. When actually riding a bicycle, what other factors affect the bicycle's true efficiency?
3. Discuss three benefits of riding a bicycle. Within your answer, explain the importance of conserving energy.

Final Thought:

On the energy of 350 calories (the amount found in one apple tart or a large slice of pizza):

- A cyclist can travel 10 miles
- A pedestrian can travel 3.5 miles
- An automobile can move 100 feet!

Think of times when you could ride a bike instead of driving – it pays to conserve energy!

Data Sheet:

D. Weight of cyclist = Input Force = _____kg

E. Force of bike against wall = Output Force = _____kg

F. Circumference of pedal rotation =
Input Distance = _____m

G. Distance bike moves in one pedal rotation = Output Distance = _____m

H. Actual Mechanical Advantage =
$\frac{\text{Output Force}}{\text{Input Force}} = \frac{\_\_\_\_\text{kg}}{\_\_\_\_\text{kg}} = \_\_\_\_$

I. Ideal Mechanical Advantage =
$\frac{\text{Input Distance}}{\text{Output Distance}} = \frac{\_\_\_\_\text{m}}{\_\_\_\_\text{m}} = \_\_\_\_$

J. Static Efficiency = $\frac{\text{AMA}}{\text{IMA}} = \_\_\_\_$

NEW!

EE Certification Program

The *new* Missouri Environmental Education Association (MEEA) Certification Program awaits you! Designed to recognize formal and non-formal educators who have attained a certain level of proficiency in the field of environmental education, this voluntary certification program provides recognition of an individual's knowledge and skills related to environmental education. It constitutes acknowledgment by MEEA that a certified environmental educator meets certain minimum preparation, professional experience and continuing education. The process of becoming certified and maintaining the designation provides incentives to continue professional development and confirms that you excel in this discipline.

A program description, certification application package, and eligibility criteria for workshop sponsors are available from the Office of Environmental Education, Missouri Department of Conservation, PO Box 180, Jefferson City, MO 65102 or by calling (573) 751-4115 ex 3370.

Mission Statement:

The Resource is published in October, December, February and April by the Office of Environmental Education. Its purpose is to provide: current information on conservation and environmental education resources and events; suggestions for integrating environmental subjects into teaching; a forum for environmental education discussion and networking in Missouri; and a clearinghouse for bringing together environmental education resources and partners.

For a free subscription or to submit information to the newsletter, write to: Office of Environmental Education, Missouri Department of Conservation, P.O. Box 180 Jefferson City, MO 65102-0180.

Editors: Syd Hime, Ginger Gray, Paulette Strader
Missouri Department of Conservation
Contributors: Missouri Department of Natural Resources, Gateway Center for Resource Efficiency, Missouri Botanical Garden
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